electrophoretic-member holding part for holding a plurality of electrophoretic members engaged in simultaneous electrophoretic operations.

The electrophoretic apparatus of the aspect can use a plurality of electrophoretic members disposed on an electrophoretic-member holding part, to conduct electrophoretic analysis on multiple test-specimens at a time.

Since the invention can thus reduce the number of separation passages per electrophoretic chip in electrophoretic analysis on multiple test-specimens, the electrophoretic chips can be manufactured more easily to thereby improve the yield, thus reducing the analysis costs.

To conduct simultaneous analysis on multiple test-specimens employing different effective electrophoretic lengths of the separation passages, a prior art electrophoretic apparatus needs to prepare one electrophoretic member provided with such a plurality of separation passages with different effective electrophoretic lengths and so conventionally finds it difficult to conduct such an analysis on multiple test-specimens under the condition of multiple effective electrophoretic lengths. In contrast, the electrophoretic apparatus of the invention, which uses a plurality of electrophoretic members, can prepare a plurality of kinds of electrophoretic members with different effective electrophoretic lengths to then select one of them that has an appropriate effective electrophoretic length and dispose it on the electrophoretic-member holding part beforehand, thus conducting simultaneous analysis on multiple test-specimens under the condition of multiple effective electrophoretic lengths.

It is the second object of the invention to provide a detecting device to realize a high S/N ratio of a detection signal.

In order to attain the second object, another aspect of an electrophoretic apparatus of the invention has a detecting part consists of a fluorescent-light detecting device for detecting a fluorescent light in a detection range, the fluorescent-light detecting device comprising: a first optical system for focusing, for image formation, a light from the detecting range into a slit hole; and a second optical system provided with a reflection-type diffraction grating, for

separating a light from the slit hole and focusing the light, for image formation, onto a detecting element.

It is the third object of the invention to provide a system to enable an electrophoretic apparatus to operate automatically.

In order to attain the third object, further aspect of an electrophoretic apparatus of the invention has an electrophoretic-medium filling mechanism for filling an electrophoretic medium into the passages and the reservoirs through the reservoirs of the electrophoretic member and a specimen injection mechanism for injecting a specimen into one of the reservoirs; and a control part for controlling the electrophoretic apparatus including the mechanisms so that they all may operate automatically.

In recent years, such electrophoretic chips are used that have a large chip size or provided with a plurality of channels or even such straight channels that have no intersection between the channels. These chips all fall in the category of the electrophoretic member of the invention.

The term "passage" in the present invention includes not only such channels as shown in the examples but also various channels such as a capillary and a closed channel.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view for showing one embodiment of the invention;

FIGS. 2A-2E are illustrations for showing one example of an electrophoretic chip in which the many separation passages are formed and which are mounted to the embodiment shown in FIG. 1, of which FIG. 2A is a top view for showing one substrate, FIG. 2B is a top view for showing the other substrate, FIG. 2C is a top view for showing a state where both substrates are connected on one another, FIG. 2D is an expanded top view for showing a part encircled in FIG. 2C, and FIG. 2E is a cross-sectional view for showing a part of the separation passages of FIG. 2C;

FIG. 3 is a partial perspective view for showing an embodiment of an electrophoretic apparatus provided with a preferred fluorescent-light detecting device;

FIG. 4 is a perspective view for showing another fluorescent-light detecting device;

FIG. 5 is a schematic configuration diagram for showing an embodiment provided with a specimen-injection monitor mechanism;

FIG. 6 is a flowchart for showing operations of the embodiment of FIG. 5;

FIG. 7 is a plan view for showing a simplified electrophoretic chip as well as an expanded illustration for showing an intersection between a specimen-injection passage and a separation passage when a specimen is introduced;

FIGS. 8A-8C are illustrations for showing an electrophoretic chip in which many separation passages are formed, of which FIG. 8A is a top view for showing one substrate, FIG. 8B is a top view for showing the other substrate, and FIG. 8C is a top view for showing a state where both substrates are connected on one another;

FIG. 9 is a graph for showing a detection signal where specimens, labeled with four kinds of fluorescent materials with different fluorescent wavelengths, are separated and detected using the electrophoretic chip of FIG. 8C;

FIG. 10 is a schematic configuration diagram for showing an embodiment provided with another specimen-injection monitor mechanism;

FIG. 11 is a perspective view for showing a schematic configuration of an embodiment in which operations are automated;

FIG. 12 is a flowchart for showing an example of the operations of the embodiment of FIG. 11;

FIG. 13 is a flowchart for showing another example of the operations of the embodiment of FIG. 11; and

FIGS. 14A-14C are illustrations for showing a prior art electrophoretic chip, FIG. 14A of which is a top view for showing one substrate, FIG. 14B is a top view for showing the other substrate, and FIG. 14C is a side view for showing a state where both substrates are connected one on the other.